

1 JUNE 2000



Operations Support

**MODELING AND SIMULATION (M&S)
SUPPORT TO ACQUISITION**

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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Pages: 11
Distribution: F

This instruction implements Air Force Policy Directive (AFPD) 16-10, *Modeling and Simulation Management*, by mandating tailored M&S use in Acquisition. This instruction supersedes SAF/AQ Policy 97A-004, *M&S Support of USAF Acquisition Process*, Nov 97. Additional instructions may be developed mandating tailored M&S use in other functional disciplines such as Test and Evaluation (T&E), Intelligence, Logistics, and any other areas as required. Air Force M&S support to acquisition is consistent with the DoD M&S vision, as delineated in the DoD 5000.59-P, *M&S Master Plan*. Send proposed revisions to the M&S Office of Primary Responsibility (OPR) for your command, who will in turn consolidate and forward them using AF Form 847, *Recommendation for Change of Publication* to HQ USAF/XOCA, Modeling, Simulation, and Analysis Programs Division, 1480 Air Force Pentagon, Washington DC 20330-1480 with an information copy to SAF/AQI, C4 Systems Integration Division, 1060 Air Force Pentagon, Washington DC 20330-1060. Major Command (MAJCOM) OPRs must send their consolidations by 15 March of each year. Maintain and dispose of records created as a result of processes prescribed in this publication in accordance with AFMAN 37-139, *Records Disposition Schedule*. Refer to Attachment 1 for a glossary of references, abbreviations, acronyms and terms.

Section A—General

1. Applicability. This AFI applies to all Air Force acquisition programs at all stages of acquisition regardless of acquisition category, even though the requirement for specific uses of M&S will vary by program.

2. Vision. The vision for M&S support to acquisition is to have a process enabled by robust, collaborative use and re-use of M&S technology that is integrated across acquisition phases and programs. The objectives are to: 1) reduce cost, schedule, performance and supportability risk, 2) reduce the time between requirements definition and delivery of capabilities (systems and processes), 3) reduce infrastructure, resource, and personnel usage, 4) improve warfighter capabilities, 5) reduce total system life-cycle costs, 6) increase the quality, military operational effectiveness and suitability, interoperability,

and supportability of fielded capabilities, 7) enhance effectiveness of trade-offs of cost, schedule, performance, and supportability, and 8) reduce duplication of M&S efforts and tools.

3. Purpose. The purpose of this AFI is to: 1) guide the direction of M&S in acquisition, 2) implement DoD policy for using M&S in the acquisition process, 3) guide USAF M&S investment strategy, 4) ensure M&S acquisition products are effective, suitable, reusable, and 5) link M&S use in acquisition to requirements generation, testing, logistics, training and education.

Section B—M&S Management Activities and Resource Policy

4. Management Activities. This AFI describes the use of M&S throughout the acquisition life-cycle process, including research, development, T&E, procurement, sustainment, and training to help ensure delivery of needed capabilities to our warfighters. The AFI addresses three major M&S management activities: 1) Master Planning, 2) Program Planning/Execution and 3) M&S Infrastructure Development/Maintenance.

4.1. Master Planning. The objective of master planning is two-fold: 1) support program managers (PMs) in the development and execution of their program M&S strategy and 2) foster the development and maintenance of an M&S infrastructure of common-use M&S tools useful to the acquisition community which are consistent, valid and interoperable. This master planning will be documented in an Air Force Acquisition M&S Master Plan. The Air Force Acquisition M&S Master Plan will support the Air Force M&S Master Plan.

4.2. Program Planning/Execution. DoDD 5000.2-R requires PMs to integrate the use of M&S within program planning activities and across functional disciplines. There are three major M&S activities the PM undertakes to accomplish this integration: 1) plan for the integrated use of M&S throughout the system's life cycle including definition of M&S requirements derived from the Operational Requirements Document (ORD) and identification of available M&S resources and M&S support infrastructure, 2) use existing M&S during the program prior to initiating development/modification of M&S products and support reuse of M&S across the Air Force to the maximum extent possible, and 3) deliver and support M&S products such as product models as defined in the ORD or Program Management Directive (PMD). The M&S strategy to accomplish these activities will be included as part of the Acquisition Plan or Single Acquisition Management Plan (SAMP) and documented in a separate M&S Support Plan. The requirement for a separate M&S Support Plan may be waived by the Program Executive Officer (PEO) or Designated Acquisition Commander (DAC). The M&S strategy, as documented in the Acquisition Plan/SAMP and M&S Support Plan, will provide a consistent source of information for M&S use in the program and support the acquisition strategy.

4.2.1. An M&S strategy will illustrate how the use of models and simulations will benefit the program and address how the program will meet DoD M&S mandates such as the use of High Level Architecture (HLA). The strategy is framed around development of a Distributed Product Description (DPD) in an integrated manner across three dimensions: 1) the M&S hierarchy of campaign, mission, engagement, and engineering models, 2) the contextual domain of models including requirements definition, design, cost, performance, military worth, sustainability, T&E, and 3) the life-cycle of the system from early requirements planning stages through acquisition, evaluation, fielding, sustainment, and disposal. These DPDs provide a configuration-controlled information source for the program. Integrating across these dimensions provides maximum

reuse, continuity, and traceability of M&S, scenarios and data and helps document program decisions and their rationale.

4.2.2. The DPD provides a common focal point for an acquisition program by integrating information about the characteristics of a product with its performance parameters and projected operational behavior. Broadly speaking, a DPD collectively describes the capability being delivered to the warfighter in order to support training, testing, analysis, mission planning, and operational status assessments. The DPD should be maintained throughout the operational life-cycle of the capability it represents consistent with direction provided in the ORD and PMD. Operational Safety, Suitability, and Effectiveness (OSS&E) requires that the PM establish a well-maintained set of documentation that support the establishment and preservation of the OSS&E baseline - the DPD provides the construct within which the OSS&E baseline information can be maintained.

4.2.3. The planning effort should result in identification of available models and simulations such as the Air Force Standard Analysis Toolkit and other models and simulations useful for requirements definition, design, engineering, cost analysis, manufacturing, sustainability, threats and T&E. Some of these models may be available through M&S repositories such as the Air Force Modeling and Simulation Resource Repository (MSRR). All model and simulation development and documentation accomplished by the program for delivery will be in accordance with applicable commercial and government standards, the Air Force Acquisition M&S Master Plan and established release policy. Models and simulations used during the course of the program are subject to Verification, Validation and Accreditation (VV&A) in accordance with DoDI 5000.61 prior to use for program decisions or delivery to customers.

4.3. M&S Infrastructure Development/Maintenance. M&S infrastructure includes both program-specific and non-program-specific (i.e. common-use) models, simulations, scenarios, facilities, databases, environments, and other M&S resources used to support acquisition. In addition to delivery of models & simulations to improve warfighter capabilities as defined in the ORD, programs will be required to deliver key models and simulations, including DPDs developed or modified during an acquisition, to the acquisition community for reuse as defined in the PMD. The PM will work with the office designated by Air Force Materiel Command (AFMC) to determine which DPDs, M&S tools, data and other products are key and need to be retained by the acquisition community. AFMC will then work with SAF/AQI to ensure these requirements are specified in the PMD and advocate for funding if these requirements are not in the ORD. The PM will transition M&S products identified for reuse along with their documentation to the AFMC-identified M&S owner. This owner will then have the responsibility for configuration control and maintenance of the M&S products. AFMC will also develop a process to identify and prioritize common-use M&S infrastructure requirements from across the Air Force.

5. Resource Policy.

5.1. Master Planning. AFMC, with the assistance of HQ USAF/XO and SAF/AQ, will provide resources to accomplish acquisition M&S master planning.

5.2. Program Planning/Execution. Programs will provide for the development and maintenance of DPDs required to support program office acquisition activities. Individual program direction and funding for these DPDs will be accomplished through the program's acquisition management chain.

5.3. M&S Infrastructure Development/Maintenance. Development and maintenance of the M&S infrastructure will be accomplished through either user funding or corporate funding. Program-specific M&S infrastructure intended for use by a specific user should, in general, be funded by that user. Common-use M&S infrastructure needed by multiple users should, in general, be corporately funded. AF/XOC, in coordination with SAF/AQI, is the approval authority for the funding approach to be used. AF/XOC will notify the using command for user-funded M&S infrastructure to ensure the ORD reflects this requirement. AF/XOC will forward corporate funding requirements to SAF/AQI to process through the Air Force corporate structure. SAF/AQI will ensure these M&S requirements are specified in the appropriate PMDs once funding is identified. The Acquisition M&S Master Plan will include a description of the process AFMC will use to identify and prioritize common-use M&S infrastructure requirements from across the Air Force in order to make funding recommendations to AF/XOC and SAF/AQI.

Section C— Responsibilities for M&S Management and Resourcing

6. HQ USAF Responsibilities. The Assistant Vice Chief of the Air Force (AF/CVA) is the approval authority for modeling, simulation, and analysis policy.

6.1. The Directorate of Command and Control (AF/XOC) is designated as the Office of Primary Responsibility (OPR) for M&S policies, issues and activities within the Air Force and represents the Air Force in joint, multi-service, and multi-agency M&S efforts. AF/XOC leads development of Air Force M&S policy for AF/CVA approval. AF/XOC will work with SAF/AQI to fund key DPDs and other M&S requirements not specified in an ORD but identified by AFMC as requiring development for retention and re-use by the acquisition community.

6.2. The Directorate of Intelligence, Surveillance, and Reconnaissance (AF/XOI) is the AF Executive Agent for threat modeling issues. National Air Intelligence Center (NAIC) is designated as the Threat Modeling Development Agent to work directly with AFMC and PMs on threat model requirements. The intelligence community is the owner of threat models and is responsible for threat model development and maintenance, and has authority for Verification and Validation (V&V) of all threat representations in accordance with DoDD 5000.59.

7. SAF/AQ. The Office of the Assistant Secretary of the Air Force (Acquisition), SAF/AQ, has primary responsibility for Air Force acquisition and program management policy. The Mission Area Directorate for Information Dominance, SAF/AQI, is designated as the OPR for Air Force acquisition M&S policy. In connection with the use of M&S in Air Force acquisition programs, SAF/AQI will ensure that the appropriate PMDs include specific direction necessary to ensure the requirements of this and related M&S policy directives and instructions are met. SAF/AQI will work with AFMC and AF/XOC to fund key DPDs and other M&S common-use requirements not specified in an ORD but identified by AFMC for development and retention for re-use by the acquisition community.

8. AFMC. AFMC supports the PM by providing technical assistance, infrastructure, test capabilities, laboratory support, professional education, training and development, and all other aspects of support for the Air Force Acquisition Executive, PEO, DAC, and PM functions. In regard to the use of M&S in Air Force acquisition programs, AFMC has two primary objectives: 1) provide support to PMs to develop and execute their program M&S strategy and 2) foster the development and maintenance of an M&S infrastructure of key DPDs and related common-use M&S tools useful to the acquisition community which are

consistent, valid and interoperable. AFMC will accomplish these objectives through the development and execution of the Air Force Acquisition M&S Master Plan. This plan will capture the Air Force vision of M&S use in acquisition as well as describe the goals and processes involved to obtain this vision. AFMC will update the Master Plan periodically as needed. AFMC will designate an OPR within the command to ensure the AFMC responsibilities outlined below are accomplished:

8.1. Support to PMs. AFMC will support PMs in the development and execution of their program M&S strategy and M&S Support Plan in accordance with the Air Force Acquisition M&S Master Plan. This includes assisting PMs in determining requirements for DPDs and related M&S products, as well as supporting the PMs in the planning, use, development, release and delivery of these M&S products. AFMC will:

8.1.1. Assist PMs in identifying valid resources to meet their M&S requirements and coordinate these requirements with the appropriate OPR.

8.1.2. Provide support to PMs and MAJCOM Analysis of Alternatives (AoA) Study Directors in their use of M&S in performing AoAs. Make available to PMs M&S information and products developed for the MAJCOM Study Directors. In fulfilling these responsibilities, AFMC will assist the MAJCOM AoA Study Director to:

8.1.2.1. Include M&S support planning in AoA activities.

8.1.2.2. Identify existing models, simulations, and other M&S products that may be re-used in AoAs.

8.1.2.3. Develop and maintain initial product models required for AoA activities.

8.1.2.4. Develop policies and procedures governing the release of product models and associated databases developed in support of AoA activities.

8.2. Support to M&S Infrastructure Development/Maintenance. AFMC will coordinate between M&S users and owners within and outside the Command to support and advocate funding for consistent, valid, and interoperable common-use M&S efforts in accordance with the Air Force Acquisition M&S Master Plan. AFMC will:

8.2.1. Develop a process to collect and prioritize acquisition-related M&S requirements (DPDs, threat models, data and environments) from across the Air Force and identify key DPDs and other common-use M&S related products developed by acquisition programs that will be retained for re-use.

8.2.2. Identify appropriate M&S owners within AFMC responsible for management and maintenance of DPDs and other common-use M&S products identified for re-use.

8.2.3. Provide the prioritized list of M&S requirements and recommended M&S owners to AF/XOC for approval. Provide the prioritized list of threat model requirements approved by AF/XOC to AF/XOI as the Air Force Executive Agent for threat models. Work with SAF/AQI to ensure these requirements are specified in appropriate PMDs and advocate for approval, support and funding through AF/XOC and SAF/AQI if these requirements are not in an ORD.

8.2.4. Develop guidelines and procedures governing the release of Program Office-owned or managed DPDs consistent with current Air Force policy. These guidelines and procedures will address appropriate security issues.

9. PEO/DAC. An M&S Support Plan is required for each program unless waived by the PEO or DAC. The PEO or DAC will consider the relative importance of M&S in the program prior to making this decision.

10. Program Manager (PM). It is important to note that the M&S activities undertaken by the PM constitute an important source of information for establishing and preserving the OSS&E baseline. Consistent with PMD direction and available funding, the PM is responsible to:

10.1. Develop the M&S strategy to guide the use of M&S support throughout the life-cycle of the system being acquired. This strategy shall be part of the Acquisition Plan/SAMP. Additionally, the M&S strategy will be documented in the M&S Support Plan unless the creation of the M&S Support Plan is waived by the PEO or DAC. This strategy shall be updated prior to each milestone review and briefed at SAF/AQ portfolio reviews and at other program reviews as determined by the PEO or DAC. To develop the M&S strategy and M&S Support Plan, the PM will:

10.1.1. Obtain any initial M&S support planning developed during pre-milestone 0 and pre-milestone I activities (see paragraph 8.1.2.1.).

10.1.2. Work with product end-user, operational requirements advocate(s), AFMC-designated office, developmental and operational testers, the intelligence community and other programs and relevant organizations to develop and implement a teamed Government/industry M&S strategy and M&S Support Plan that leads to M&S products that can be transitioned and used throughout the acquisition life-cycle, including both T&E and training.

10.1.3. Ensure that the M&S strategy and M&S Support Plan address establishment and maintenance of a DPD.

10.2. Provide M&S requirements (DPDs, threat models, data and environments) not in a PMD or ORD to the AFMC-designated office collecting these requirements (see paragraph 8.2.1.).

10.3. Consult the AFMC-designated office for guidance on the status and availability of applicable M&S resources (capabilities, V&V status, and future plans), and for guidance on developing an M&S strategy and M&S Support Plan for their program (see paragraph 8.1.).

10.4. Work with the AFMC-designated office to identify and obtain initial DPDs and supporting M&S infrastructure, including applications, databases, and historic material that is relevant to their program (see paragraph 8.1.).

10.5. Develop and be responsible for configuration control of current DPDs and other M&S products required to support program office acquisition activities (see paragraph 8.1.).

10.6. Coordinate with the AFMC MSRR Resource Coordinator and Air Force Agency for Modeling and Simulation (AFAMS) to ensure applicable information from the program's M&S strategy and DPDs are linked to the AF MSRR (see paragraph 11.).

10.7. Coordinate with the Air Force Operational Test and Evaluation Center (AFOTEC) to ensure program use of M&S is consistent between the program office and the operational testers (see paragraph 12). Also, coordinate with relevant training organizations (e.g. C2 Training and Innovation Group (C2TIG) for C2 acquisitions).

10.8. Assume responsibility for V&V of models and simulations developed within the program in accordance with DoDI 5000.61 (see paragraph 4.2.3.).

10.9. Assume responsibility for accreditation of all models and simulations used in support of the program office (see paragraph 4.2.3).

10.10. Work with the AFMC-designated office to determine what program-developed common-use M&S products will be retained for re-use and to transition those products to AFMC-identified owners who will be responsible for configuration control and maintenance of the M&S products and make these products available through the MSRR (see paragraph 8.2.). The decision to retain and transition common-use M&S products should be made at the earliest opportunity so that this requirement can be documented in the PMD and the funding identified.

11. AFAMS. AFAMS is a field operating agency of AF/XOC and is responsible to:

11.1. Act as the MSRR management agent. AFAMS will facilitate user access to DPDs and other M&S products by establishing and maintaining MSRR links to web sites designated by the agency responsible for configuration control of the M&S products.

11.2. Act as OPR to develop and maintain the Air Force M&S Master Plan.

12. AFOTEC. AFOTEC is a direct reporting unit under Air Force Headquarters responsible for the independent testing, under operationally realistic conditions, of systems being developed for Air Force and multi-service use. AFOTEC is responsible to:

12.1. Provide M&S resource requirements for Operational Test and Evaluation (OT&E) sufficiently early to be included in the ORD, the acquisition strategy, the SAMP, the M&S Support Plan, the Test and Evaluation Master Plan (TEMP), and the request for proposal (see paragraph 10.1.2.).

12.2. Advise the PM about development and VV&A of M&S resources during the acquisition process, and employ those resources at appropriate times (see paragraphs 10.8. and 10.9.).

13. Operating Commands/Agencies. Operating Commands/Agencies are responsible for supporting the development of the Air Force Acquisition M&S Master Plan. Additionally, Operating Commands are responsible to: 1) ensure the ORD addresses M&S requirements (to include the necessity to use DPDs during AoAs in accordance with AFI 10-601, Mission Needs and Operational Requirements Guidance and Procedures), 2) provide acquisition-related M&S requirements that are not in an ORD or PMD to AFMC (see paragraph 8.2.1.), and 3) support M&S accreditation activities as appropriate.

MARVIN R. ESMOND, Lt Gen, USAF
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Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

DoDD 5000.1, *Defense Acquisition*, Mar 96

DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs), Major Automated Information Systems (MAIS) Acquisition Programs*, Mar 96

DoDD 5000.59, *DoD Modeling and Simulation (M&S) Management*, Jan 94

DoDD 5000.59-P, *DoD Modeling and Simulation (M&S) Master Plan*, Oct 95

DoDD 5000.59-M, *DoD Glossary of Modeling and Simulation (M&S) Terms*, Jan 98

DoDI 5000.61, *DoD Modeling and Simulation Verification, Validation, and Accreditation (VV&A)*, Apr 96

DoD Verification, Validation and Accreditation (VV&A) Recommended Practices Guide, Nov 96

AFI 10-601, *Mission Needs and Operational Requirements Guidance and Procedures*, Oct 98

AFPD 16-10, *Modeling and Simulation Management*, Jun 97

AFI 63-123, *Evolutionary Acquisition Process for C2 Systems*, Apr 00

USD(A&T) Memo, *DoD High Level Architecture for Simulations*, Sep 96

SAF/AQ Policy 97A-004, *M&S Support of USAF Acquisition Process*, Nov 97

AFI 63-1201, *Assurance of Operational Safety, Suitability, & Effectiveness*, Feb 00

Abbreviations and Acronyms

AFAMS—Air Force Agency for Modeling and Simulation

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFMC—Air Force Materiel Command

AFOTEC—Air Force Operational Test and Evaluation Center

AFPD—Air Force Policy Directive

AoA—Analysis of Alternatives

C2TIG—C2 Training and Innovation Group

DAC—Designated Acquisition Commander

DCS—Deputy Chief of Staff

DoDD—Department of Defense Directive

DoDI—Department of Defense Instruction

DPD—Distributed Product Description

DSM—Digital System Model
HLA—High Level Architecture
LMT—Legacy Model Transition
M&S—Modeling and Simulation
MAJCOM—Major Command
MSRR—Modeling and Simulation Resource Repository
NAIC—National Air Intelligence Center
OPR—Office of Primary Responsibility
ORD—Operational Requirements Document
OSS&E—Operational Safety, Suitability, & Effectiveness
OT&E—Operational Test & Evaluation
PEO—Program Executive Officer
PDO—Publishing Distribution Office
PM—Program Manager
PMD—Program Management Directive
SAMP—Single Acquisition Management Plan
T&E—Test and Evaluation
TEMP—Test and Evaluation Master Plan
V&V—Verification and Validation
VV&A—Verification, Validation, and Accreditation

Terms

Accreditation —Official determination that a model or simulation is acceptable for use for a specific purpose

Air Force Standard Analysis Toolkit—Part of the AF/XOC Legacy Model Transition (LMT) Plan, created in an effort to establish a standard toolkit of models for the analysis community. The plan identifies a suite of current models, called Toolkit Models, which are considered the Air Force standard for modeling various activities in combat.

Architecture —Structure of components in a program/system, their interrelationships, and the principles and guidelines governing their design and evolution over time

Behavior —For a given object, how attribute value changes affect (or are affected by) the object value changes of the same or other objects

Campaign —Simulations that attempt to emulate all elements of aerospace power over the duration of a conflict and across the theater or theaters of operations. Time scale is normally in days to weeks. Represents the strategic and operational levels of warfare.

Configuration Management —Application of technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a model or simulation, control changes, and record and report change processing and implementation status.

Data —Representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means.

Digital System Model (DSM) —Software representation of a system, used to characterize dynamically the expected effects of changes in assumptions, design, tactics, or doctrine. DSMs embody system requirements and characteristics such that they can be actively evaluated in a common digital environment starting with concept exploration and progressing throughout the system life-cycle including analysis, design, test, training, and logistics.

Distributed Product Description (DPD) —A distributed collection of product-centric information that is interconnected via web technology into what appears (to the user) to be a single, logically unified data base. DPDs are composed primarily of three types of information: product data, product models, and process models. Product data specifies the characteristics of a product at any point in its development cycle, manufacturing data, and test data. Product models are authoritative software representations of a product that have been developed to operate within specific simulations or other analytic environments (e.g., JMASS, JWARS, JSIMS, etc.). Process models are used to describe/document the business operations necessary to define, develop, manufacture, deploy, and dispose of the product throughout its life cycle. DPDs may also contain other relevant product-related information, such as functional descriptions of product behavior and various categories of applicable metadata (e.g., VV&A status).

Engagement (Sub-mission) —Simulations which provide measures of effectiveness at the system level by evaluating system effectiveness against enemy systems.

Mission —Simulations of one or more interacting elements of aerospace power across all or part of the theater of operations. Time scale normally in hours. May represent the operational and tactical levels of warfare.

Model —A physical, mathematical, or otherwise logical representation of a system entity, phenomenon, or process.

Object —Physical or logical structures (models) that keep their characteristics and behavior together

Process Model —Provide detailed definitions of the engineering, development and evaluation processes used to design and develop the product. Specifically, process models provide information and knowledge on how to use various tools and resources to perform the numerous scientific, engineering, development and evaluation tasks associated with technology and product development.

Product Model —Authoritative representations of product behavior and performance. Each product model referenced in a DPD reflects an actual software implementation of the product (data and methods) that has been developed to operate in a specific static analysis tool or dynamic virtual environment. Each product model is based on a common functional and operational description (included in the DPD) that provides the basis for verification and validation of the model. Digital System Models (DSMs) are product models.

Requirement —An established need that justifies the timely allocation of resources to achieve a capability to accomplish approved military objectives, missions, or tasks.

Simulation —A method for implementing a model over time. Also a technique for testing, analysis, or

training where real-world systems are used, or where a model reproduces real-world and conceptual systems.

System/Subsystem/Component—Detailed engineering or scientific simulation of a single system, subsystems, and components across ranges of operations and environments. Time scales range from microseconds to minutes or more. May represent the tactical level of warfare.

Validation —Rigorous and structured process of determining the extent to which M&S accurately represents the intended "real world" phenomena from the perspective of the intended M&S use.

Verification —Process of determining that M&S accurately represent the developer's conceptual description and specifications.